

CLAIMS

What is claimed is:

1. A fastening element, comprising:

a mandrel including a foot and a head, the head having a head diameter greater than a mandrel diameter; and

a hollow shank including:

a setting head at a free end;

a deformation segment operably forming a closure head;

a connecting segment configurable inside the shank operably forming a tension-resistant connection with the mandrel foot; and

a shank end opposed to the setting head having a punching edge extending substantially along an outermost periphery of the shank.
2. The fastening element of Claim 1, wherein the shank and the mandrel are positively connectably geometrically.
3. The fastening element of Claim 1, wherein the shank and the mandrel are detachably connectable.
4. The fastening element of Claim 3, wherein the shank and the mandrel are threadably connectable.

5. The fastening element of Claim 4, wherein the mandrel foot and the shank end are threadably connectable.

6. The fastening element of Claim 5, comprising:
the mandrel foot including an external thread; and
the shank end including an internal thread engageable with the external thread of the mandrel foot.

7. The fastening element of Claim 1, comprising:
the mandrel foot having a first diameter; and
an outside of the shank end having the punching edge formed thereon having a second diameter;
wherein the first diameter is one of equal to and greater than the second diameter.

8. The fastening element according to Claim 1, wherein the mandrel comprises a weak spot.

9. The fastening element of Claim 1, wherein the setting head comprises a diameter greater than any one of a deformation segment diameter, a shank end diameter and a mandrel foot diameter.

10. The fastening element of Claim 1, wherein the fastening element comprises a metal.

11. The fastening element of Claim 10, wherein the metal comprises at least one of steel, aluminum and an aluminum alloy.

12. The fastening element of Claim 1, wherein a cross section of the fastening element is substantially circular.

13. The fastening element of Claim 1, wherein a cross section of the fastening element is substantially polygonal.

14. The fastening element of Claim 1, wherein the mandrel head comprises a fastener driving element.

15. The fastening element of claim 1, wherein the shank comprises an open end.

16. The fastening element of claim 1, wherein the shank comprises a closed end.

17. A fastening element adaptable for blind riveting, the fastening element comprising:

a hollow shank having a free end formable as setting head and a shank end opposed to the setting head;

a deformation segment operable to form a closure head; and

a mandrel positionable inside the hollow shank, the mandrel having a head and a foot, the foot being at least fastenably connectable to the shank end;

wherein one of the shank end and the mandrel foot include a punching edge extending substantially along an outermost periphery of one of the shank and the mandrel foot.

18. The fastening element of Claim 17, wherein the shank and the mandrel, in particular the foot of the mandrel and the end of the shank, are threadably connectable.

19. The fastening element of Claim 17, wherein the mandrel comprises a weak spot, operably forming a cavity in the mandrel between the head and the foot.

20. The fastening element of Claim 19, wherein the mandrel includes a square-shaped core adjacent to the weak spot.

21. A fastener setting system, comprising:
- a fastener including:
 - (i) a first mandrel having a foot; and
 - (ii) a hollow shank including:
 - (a) a setting head at a free end;
 - (b) a deformation segment for forming a closure head;
 - (c) a connecting segment configurable inside the shank operably forming a fastenable connection with the mandrel foot; and
 - (d) a shank end opposed to the setting head having a punching edge extending substantially along an outermost periphery of the shank;
 - a die;
 - a ram including a second mandrel detachably connectable to the fastening element; and
 - a holding tool to hold the setting head against a work, the ram and the holding tool being movable relative to the die independently of each other.

22. A device, comprising:

- a fastening element having a setting head and a mandrel engageable into at least one part;
- a die;
- a ram operably punching the fastening element through the at least one part;
- a holding tool operably holding the setting head against the at least one part; and
- a traction tool operably retracting the mandrel;

wherein the ram and the holding tool are movable relative to the die independently of each other.

23. The device of Claim 22, wherein the mandrel comprises an external thread operably forming a releasable connection with the fastening element.

24. The device of Claim 22, wherein the die comprises a disposal passage operably disposing each of a plurality of punched parts.

25. The device of Claim 22, comprising a counterforce structure operable to dynamically interlock the ram and the die.

26. The device of claim 22, comprising at least one of:
- a moving means;
 - a means for determining a ram position;
 - a means for determining a holding tool position; and
 - at least one force sensor operably detecting a force involved in setting a rivet.

27. A fastening element system, the system comprising:
- a fastening element including:
 - a mandrel; and
 - a hollow shaft including:
 - a setting head at a shaft first end;
 - a deformation segment operably forming a closure head;
 - a connecting segment configurable inside the shaft;
 - and
 - a shaft second end opposed to the setting head having a punching edge extending substantially along an outermost periphery of the shaft;
 - a die operable to create a punch opening having a variable diameter in the at least one part, the die including at least two segments operably absorbing a punching force and operably forming the punch opening capable of accommodating the closure head of the fastening element;
 - a die receptacle having the segments movably lodged therein; and
 - at least one spring element operably holding the segments together.
28. The system of Claim 27, wherein the segments are radially displaceable.

29. The system of claim 27, comprising:
- each segment including a planar bearing surface; and
- the die receptacle including a substantially planar countersurface
- operably transmitting the punching force to the die receptacle.
30. The system of Claim 27, wherein each segment comprises a spring element receptacle.
31. The system of Claim 27, wherein the die receptacle comprises an annular stop.
32. The system of claim 31, further comprising:
- the annular stop including an annular stop surface; and
- each segment including a segment stop surface;
- wherein the segment stop surface is positionable behind the annular stop surface in relation to the at least one part by a distance ranging between 0.1 to 0.3 mm, the distance operably ensuring mobility of the segments during a fastening element setting operation.
33. The system of Claim 32, wherein the distance ranges between 0.15 mm to 0.25 mm.
34. The system of Claim 27, comprising less than five segments.

35. The system of Claim 27, wherein the spring element comprises a rubber ring.

36. The system of Claim 27, wherein the spring element comprises a spiral ring.

37. The system of Claim 27, wherein the die comprises a transversely extendable vent hole.

38. The system of Claim 27, wherein the punch opening formable by the segments comprises a rotationally asymmetrical cross section.

39. The system of Claim 38, wherein the punch opening comprises a substantially polygonal cross section.

40. The system of Claim 39, wherein the punch opening comprises a tooth when viewed in cross section.

41. A process for setting a fastening element, the fastening element including a hollow shank having a setting head at its free end, a deformation segment, and a connecting segment, a shank end opposed to the setting head being provided with a punching edge, the process comprising:

- introducing the mandrel into the fastening element;
- fastenably connecting the mandrel and the shank;
- carrying out a punching operation with the fastening element and the mandrel to form a punched hole in at least one of a first part and a second part;
- introducing the shank into the punched hole so that the shank extends at least partially into the punched hole; and
- applying a tension to the mandrel operable to back up the deformation segment toward the setting head and form a closure head.

42. The process of claim 41, comprising operably extending the shank end through at least one of the first part and the second part until the deformation segment protrudes at least partly from the punched hole at a rear of one of the first part and the second part.

43. A process for setting a fastening element having a hollow shank, the hollow shank including a setting head at a free end, a deformation segment, and a mandrel inside the shank, the mandrel having a head and a foot, one of shank free end and the mandrel foot including a punching edge, the process comprising:

carrying out a punching operation with the fastening element and the mandrel to form a punched hole in at least one of a first part and a second part;

introducing the shank into the punched hole so that the shank extends at least partially into the punched hole; and

applying a tension to the mandrel operable to back up the setting head and form a closure head.

44. The process of claim 43, comprising:

connecting at least the first part and the second part of the fastening element with each other; and

punching through at least the first part during the connecting step.

45. The process of claim 43, comprising forcing the mandrel into the work with at least one of a preassigned force and a preassigned travel.

46. The process of claim 43, comprising one of releasing and restoring a connection between the mandrel and the fastening element after formation of the closure head.

47. The process of claim 43, comprising forming a screw connection between the mandrel and the fastening element.

48. The process of claim 47, comprising screwing the mandrel into an internal thread of the fastening element until the mandrel protrudes beyond the setting head.

49. The process of Claim 43, comprising forming a riveted connection between the first part and the second part.

50. The process of Claim 49, comprising employing the riveted connection to releasably fasten a plurality of accessory parts to the at least one part, the accessory parts including at least one of a line, a holder, a fairing and a housing part.